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ABSTRACT

The use of simulation games in the classroom has greatly increased over the past decade. However, little attention has been given to the need for a set of programs -- an instructional model -- that will enable teachers to use these games in a consistent and effective manner. This paper describes such an instructional model and provides a classroom evaluation of the model's application. (Author)

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MAY, 1973

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The Johns Hopkins University

Baltimore, Maryland

INTRODUCTORY STATEMENT

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through five programs to achieve its objectives. The Academic Games program has developed simulation games for use in the classroom. It is evaluating the effects of games on student learning and studying how games can improve interpersonal relations in the schools. The Social Accounts program is examining how a student's education affects his actual occupational attainment, and how education results in different vocational outcomes for blacks and whites. The Schools and Maturity program is studying the effects of educational experience on a wide range of human talents, competencies, and personal dispositions in order to formulate -- and research -- important educational goals other than traditional academic achievement. The School Organization program is currently concerned with authority-control structures, task structures, reward systems, and peer group processes in schools. The Careers and Curricula program bases its work upon a theory of career development. It has developed a self-administered vocational guidance device and a self-directed career program to promote vocational development and to foster satisfying curricular decisions for high school, college, and adult populations.

This report, prepared by the Academic Games program, describes an instructional model designed to improve the use of complex simulation games in the classroom.

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ABSTRACT

The use of simulation games in the classroom has greatly increased over the past decade. However, little attention has been given to the need for a set of programs -- an instructional model -- that will enable teachers to use these games in a consistent and effective manner.

This paper describes such an instructional model and provides a classroom evaluation of the model's application.

INTRODUCTION

The use of simulations and games for instructional purposes has increased over the last decade. In fact, Zuckerman and Horn (1970 and 1973) indicate that the increase has been nearly exponential. However, this increase in use has not been accompanied by a parallel increase in research efforts to determine the educational effects of the instructional approach and to indicate guidelines for their optimal use in the classroom.

The research conducted by the Academic Games Program at the Center for Social Organization of Schools, the Johns Hopkins University, has provided a number of reports concerning the effectiveness of simulation and non-simulation games. A recent summary by Livingston (1972) indicates the variety of results obtained by the Hopkins group. However, none of this research has attempted to provide overall guidelines to optimize the instructional effects of simulation games in the classroom. This report describes a preliminary model for using complex simulation games in the classroom, and an analysis of the application of the model in high school classes.

AN INSTRUCTIONAL MODEL FOR SIMULATION GAMES

To date, instructional models have dealt with the acquisition of knowledge by students. These models usually involve a clarification of instructional objectives, measures on the entering abilities of the students, the actual instruction, an evaluation, and feedback. It is tacitly assumed that the student is motivated to learn and that higher level thinking (application, analysis, synthesis, and evaluation) will be used and improved during a unit of instruction. The instructional model outlined below does <u>not</u> assume that students are always motivated to learn, nor that higher level

abilities are called into play during most classroom experiences. The essence of the model is that instruction should consist of two main phases, the first concerned with the acquisition of basic skills and knowledge, and the second concerned with an application, elaboration, and liberalization of the first phase. This type of model differs from traditional instructional models because the second phase requires the use of higher level abilities of application, analysis, systhesis, and evaluation in an "applied" but simulated environment. The first phase consists primarily of traditional classroom approaches to teaching (lecture, discussion); the second phase consists of an experience with a simulation game that increases in complexity and involvement over time.[1]

The two phases are developed in a way that reduces the effect of another major problem in most classrooms; namely, lack of motivation. The phases are structured so that learning in phase one will improve the student's functioning in phase two. That is, a student's performance in phase two (the game, or simulation) will improve if he understands all the information dealt with in phase one (the traditional classroom approach). Thus, the goal of optimum performance in the liberal phase (or any other goal embedded in the simulation or game) may sustain motivation to learn (see Coleman, 1967) in the more traditional phase.

The basic steps involved in the model include: (1) determine student competence (entering behavior); (2) introduce the unit at broad conceptual levels; (3) introduce new concepts: gaming environment, team structure,

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[1]For comments by a teacher and by students on the use of the instructional approach, see Appendix A and B, respectively.

scoring (based on performance criteria in simulation or game and class work), roles, and types of decisions to be made; (4) complete one round of decision-making with model; (5) have students try to predict results of decisions; (6) inform students of their relative performance as teams and individuals; (7) discuss effects of students' decisions, determine their understanding, and clarify their misconceptions; (8) repeat steps, 4, 5, 6, and 7 at the next higher conceptual level of model. Note that the basic curriculum phases into an "applied" curriculum during the students' experience with the simulated environment.

Figure 1 provides a schematic representation of the initial model. An application of a related model has been evaluated by Edwards (1971). A more recent application is described in the following section.

Insert Figure 1

AN APPLICATION OF THE MODEL

The simulated environment incorporated in this application was PRINCE: A Programmed Inter-Nation Simulation developed by Coplin, Mills, and O'Leary (1972). It was applied at the high school level; this was the first time the PRINCE approach has been used below the college level.

PRINCE (Programmed Inter-National Computer Environment) is a man-computer simulation of international relations developed by Coplin and O'Leary at Syracuse University. Players assume the role of foreign policy makers of the United States and cope with various issues within a framework of domestic and international political reactions. Overall, players attempt to resolve

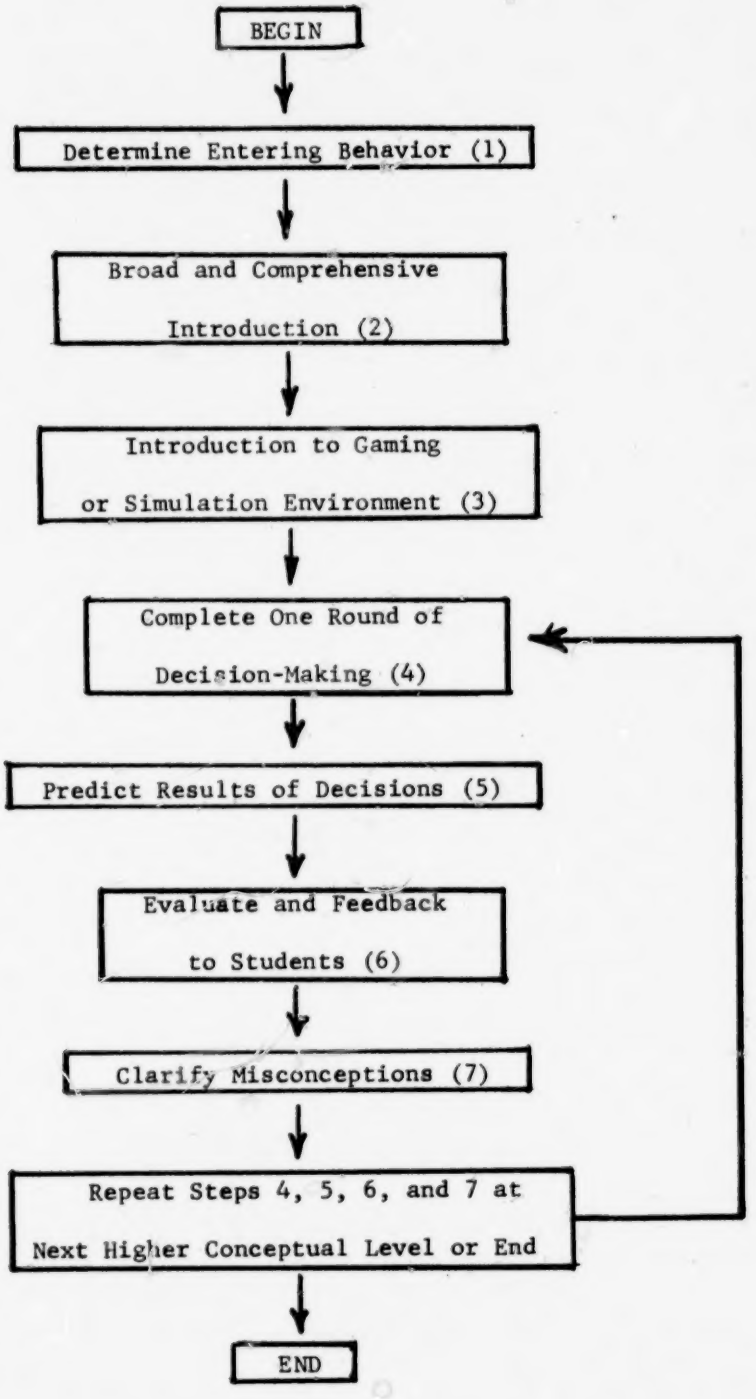
BEGIN
Determine Entering Behavior (1)
Broad and Comprehensive Introduction (2)
Introduction to Gaming or Simulation Environment (3)
Complete One Round of Decision-Making (4)
Predict Results of Decisions (5)
Evaluate and Feedback to Students (6)
Clarify Misconceptions (7)
Repeat Steps 4, 5, 6, and 7 at Next Higher Conceptual Level or End
END

Figure 1. Schematic Representation of the Simulation and Gaming Instructional Model.

issues in their favor through economic and political means while maintaining satisfactory domestic and international relations.

Study Approach

The purpose of the study was to apply a controlled instructional approach to the use of simulations at the high school level in order to examine: (1) how the instructional model would fare in actual use, and (2) how the class using the model and game approach would compare to a traditionally-taught class.

The basic materials for a one semester course in International Relations were made available from the International Relations Program at Syracuse University. A thorough study of the Manual and background data suggested that further instructional materials should be developed. Issue packets containing current new articles that were relevant to the PRINCE issues were constructed for student use in the classroom. The students were divided into teams, to increase their motivation to operate effectively in the course. Each team received identical issue packets. The modified curriculum called for data on seven of the fourteen issues in the PRINCE instructional materials.

Lesson plans were written to introduce the students to the basic concepts of international relations, e.g., nationalism, sovereignty, power. The introduction took over a week's time. Following this, the rules and procedures for playing the simulation game were taught. Sample computer "dry runs" of the simulation were examined to prepare the students for the decision-making periods. Actual game playing began the following week, with the students' decision-making restricted to one issue. (See instructional model, above. It is important to begin the decision-making at a low conceptual level.) One new issue was added each subsequent week, thus increasing the

complexity of the learning task over time. Additional aids were developed to facilitate playing the PRINCE game.

Three groups of twelth grade students participated in the study. Group 1 received a traditional course in International Relations, Group 2 received the complete experimental course involving the PRINCE computer simulations; Group 3 (in another school, but taught by the same teacher) also received the experimental treatment. From the beginning of the study, it was assumed that there would be an increase in student ability from Group 1 (low), through Group 2 (medium) and Group 3 (high). An analysis of covariance was performed in order to determine the relationship between student ability and the effect of the instructional approach.

The experimental groups were separated into teams of five to eight players. One team member was chosen as a chairman and the other members were assigned other tasks, such as becoming an "expert" on a particular country or issue. The teams were given one day to research the new issue and another day to arrive at group decisions on the various actions that can be taken when playing PRINCE. Those decisions were then given to a programmer who handled the computer runs. (It was impossible for the students to interact with the computer directly.) While the computer runs were being completed, the students attempted to predict the effects of their decisions on the simulated international and domestic environments. (The act of prediction or becoming aware of the outcomes of various strategies has been emphasized as an important component of learning from simulation games. See Fletcher, 1971, p. 443.) In addition, the students compared strategies and talked about the issue in a general class discussion. This activity was followed by a discussion of the computer feedback in light of their predictions and class discussion. This process continued until all seven issues were being

dealt with in the course.

Grades and Testing

Students were informed that grades would be based on a combination of their group effort (as reflected in the Opinion Poll on the computer feedback sheets) and by their own individual effort in class. A final exam was administered to all experimental and control groups at the close of the course. The exam consisted of 100 objective items (mostly multiple-choice with some matching) and four essays. The results of the data analysis are provided below. The experimental design involved a univariate analysis of covariance, with I.Q. as the covariate. The dependent variable was the student's score on the final exam.

Results

Table 1 contains the observed cell means for the Control Class, who received a conventional course in International Relations; Experimental Class I, who received the PRINCE instructional package; and Experimental Class II, who studied the PRINCE instructional materials in another school, taught by the same teacher. One readily observes the need for controlling I.Q.

Table 1. Observed Cell Means for Control and Experimental Classes.

	I.Q.	Final Exam
Control	102.68	52.11
Exp. I	106.74	61.42
Exp. II	116.74	74.73

Table 2 contains the statistics for the regression analysis of I.Q. on final exam. Approximately 13% of the variance in final exam scores is accounted for by I.Q.

Table 2. Statistics for Regression Analysis of I.Q. on Final Exam.

Variable	Square Mult R	Mult R	F	P Less than
Final Exam	.135	.368	8.30	.006

*Degrees of freedom for hypothesis = 1

Degrees of freedom for error = 53

Table 3 contains the statistics for the analysis of covariance determining the relative effects of the Experimental I and II Classes versus the Control Class. The Experimental II Class resulted in a treatment effect ($p < .01$) even after the effects due to I.Q. have been eliminated. Thus, the model plus complex simulation game is only effective with above average students. Nevertheless, the differences remain even after the effects due to ability have been removed statistically.

Table 3. Statistics for Analysis of Covariance: Covariate is I.Q., Dependent Variable is Final Exam.

EXPERIMENTAL I versus CONTROL

Mean Square = 4.31, F = .02, with 1 and 53 df, P less than .90

EXPERIMENTAL II versus CONTROL

Mean Square = 2048.44, F = 7.22, with 1 and 53 df, P less than .01

DISCUSSION

The experimental treatment increased class performance over a conventional approach to teaching international relations. However, the instructional model incorporated a man-computer simulation of high complexity, designed for college students, which seems to have dampened the effect of the model with average high school students. However, the study is exploratory;

now that successful application of the model has been shown, future research should be conducted to determine the effect of the model with diverse simulation games, varied team structure and scoring techniques. All that has been examined here is the total effect of the model, the importance of these elements is yet to be determined. The model plus man-computer simulation game was most effective with the high ability students. Even though the effect obtained with average students was not statistically significant, it should be noted that they did successfully complete the course of instruction and obtained rather good grades, compared to the conventional class with average students. It is encouraging to find average ability high school students handling complex man-computer simulation games designed for college students.

Decision-making and problem-solving skills are important learning outcomes which were not examined in the present study, but may yield interesting results in future studies. The suggested instructional model emphasizes the importance of making decisions and predicting the effects of these decisions before feedback is received. Simulation games seem to provide a natural environment for "exercizing" such higher-level cognitive skills. The emphasis on these skills may be justified on the basis of their generalizability to new problem situations that require immediate decisions for resolution. In complex simulations, problems continually confront the participant while the solution rests on cogent decision-making. If students receive more instruction in these skills in simulated environments, perhaps their performance in real-life will improve.

Although the instructional approach emphasized in the present paper resulted in increased student performance, research must be conducted to determine the relative effects of each element within the model. The effect-

iveness of the model may have been due to the effects of the teams, the gradual increase in complexity of the model (for maintaining motivation), or the simulation game itself. A clarification of the effects of these elements within the model can be made with programatic research.

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APPENDIX A

IMPRESSIONS OF A TEACHER

After using the PRINCE Simulation Game to teach a semester course in International Relations at the high school level, I can sum up the experience as being successful, enjoyable, and occasionally frustrating.

Perhaps the greatest success was that most of the students were highly motivated and worked much harder than they normally would have. This enthusiasm, strongest in the beginning, remained at a relatively high level throughout the semester, unlike my experience with other simulation games. Because of this, there was no question in my mind that the students have a very good insight into the process of foreign policy determination and a relatively good conceptual and factual understanding of the current state of international relations. I feel that game participation places the students in a realistic framework, enabling them to react personally and directly with action instead of only theoretically with concepts. It is in this realism that the greatest value of using PRINCE lies.

It is in this exact same area also where the basic frustration in its use also occurs. Because of occasional administrative difficulties in programming, card punching, and simply administrative error (students writing the wrong number or using the wrong order), feedback was occasionally delayed or even cameback in error. Whenever this occurred, it was as if a huge wet towel had been thrown over the entire process -- as if a betrayal had occurred. Cynicism replaced realism. This was the only real problem that existed, and I believe it could be eliminated if (1) I had better understanding of the programming, and (2) a more efficient proof-reading system had

been established to check student inputs and card punching prior to insertion in the computer.

In spite of this difficulty, which remained in spite of a very close relationship with the processor of student inputs, the overall learning experience was fruitful for the students. I felt that the use of the study guides developed for this course and used during student research on specific issues was most valuable, in that they provided those students with minimal academic ability or ignorance about a particular issue a useable concrete framework to use to develop their own positions. The lesson plans as written also appeared valid, in that they encouraged student participation and provided a logical development of the material for the teacher.

The teacher's role in the Prince game is basically twofold. First he remains a teacher -- his most difficult task is to continually make the students relate specific problems, actions, and influences in the game both to real life situations and general concepts or understandings already possessed by the students or those they need to develop. This for me was the most demanding and difficult teaching task, requiring at times more creativity and insight than I sometimes seemed to possess. The second task is one revealed to me when I found myself occasionally and dismally muttering, "This is no job for a teacher; I'm simply a bureaucratic paper-shuffler passing out and collecting forms, existing on deadlines, and relating to, explaining, and defending a machine." However unpleasant, this latter task must also be efficiently accomplished in order to attain the realism required.

Overall, however, the experience of using PRINCE was an enjoyable one for myself and the students. Most were disappointed when we stopped after eight or ten rounds; they enjoyed the competition, and they enjoyed doing

rather than being done to. Most of the students seemed to be affected or touched by the course -- they were aware of, they seemed to really understand how foreign policy is formulated and what some of the problems of the U. S. and the world today really are. It appeared that this understanding was a deep one -- one that would stay with them because they had really understood -- they experienced it. In that understanding and experience is the real value of the PRINCE Simulation Game.

APPENDIX B

STUDENTS COMMENTS

"The basic flaw, thus far, with this simulation game seems to be that many students lack the proper background information to make logical decisions. In a manner of speaking, it appears as if many are getting high PI approval by 'blind luck' and not by carefully formulated foreign policy. All in all, I feel that it would be more beneficial if the class studied all the issues in depth first and then proceeded with the game."

"The PRINCE game is good in helping us understand how complicated International Relations is, but it is not a game that can be rushed if it is to be played properly."

"Everyone was mixed up when the game first started, but I now feel that everyone understands it."

"This game gives you an open knowledge of what could happen in a real world situation and how the thinking of seven or more men can change the world. It should continue longer than we had had it to make ourselves more knowledgeable in today's problems."

"I think that the game is helpful in many ways and that we should continue it for a few weeks more."

"This is a kind of game that brings us up to date on current events and lets us objectively determine our own goals."

"I find the game very beneficial because it gives a student an idea of

what our government officials have to go through to keep everybody happy. In finding this out, it also makes a student stop and think before raising hell when something goes wrong."

"The course was very interesting and enjoyable. The PRINCE course was also taught and administered in a very interesting manner."

"I enjoyed working with the game. I feel it gave a good idea of what is happening in the world."

"This course as a whole was challenging and educational."

"I feel that the PRINCE game (not really a game) is very meaningful, and it would be very nice if more students had the opportunity to take part."

"It is the opinion of this guinea pig that the PRINCE course could be invaluable to students of political science. However, it would be most helpful if instructors could be found who completely understand the game."

"I enjoyed the course -- very challenging."